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# Agriculture's Rubber

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In the present emergency due to the shortage of natural rubber, American scientists are considering seriously every conceivable source of rubber or rubber replacements. Very prominent in this consideration is the processing of farm plants for their rubber content. In addition, large quantities of rubbery materials are being produced from farm grown oils.

One of the newest developments in the search for rubber supply extenders is the commercial production of synthetic rubber from soybeans, by Reichhold Chemicals, Inc., of Detroit. Reichhold and the United States government have been experimenting with the new rubber, termed Agripol, for more than a year. Production now is approximately 1000 tons a month, and that figure will probably be doubled by May if sufficient materials are allocated for the purpose. By further expan-

sion annual production could be increased to a minimum of 25,000 tons.

Agripol is not now offered as a replacement of rubber in automobile tires. Its many other uses, however, will allow considerable conservation of natural rubber. Some of the mechanical products that can be manufactured using Agripol are gaskets, belting, insulation, hose linings, adhesives, and many latex products. There are also many direct military uses of the rubber.

In some physical properties, such as tensile strength and resistance to abrasion, Agripol is inferior to natural rubber. The soybean rubber, however, performed equally well in flexibility tests at low temperatures, and was shown superior to natural rubber in the qualities of slowness of aging and resistance to oxidation and other attacks by the elements. One fortunate property of the new rubber is that its vulcanization temperature range is about the same as that of natural rubber. This quality permits the working of the rubber in existing fabrication and molding equipment.

The principal raw materials required for the synthesis of Agripol are soybean oil and ethylene glycol, the latter being obtained by dehydrating ethyl alcohol. By polymerizing the fatty acids from soybean oil with ethylene glycol, Agripol is produced. The customary fillers used in compounding natural rubber, including sulfur, carbon black, zinc oxide, and appropriate plasticizers, are also placed in the synthetic rubber.

Agripol was developed as a result of research begun by the Northern Regional Research Laboratories of the United States Department of Agriculture at Peoria, Illinois, which demonstrated that rubber-like products could be produced by polymerizing fatty acids extracted from vegetable oils, such as corn, cottonseed, soybean, and linseed. Some of these products will stretch 200 per cent or more, returning to their original side, and have tensile strengths of approximately 500 pounds per square inch. Natural rubber has about 600 per cent stretch, and tensile strength of 3,000 pounds or more.

There is a definite place in industry and the war effort for substitutes having only a fraction of the strength and elasticity of natural rubber.

• Dr. Herbert M. Strong, M.Sc., '32, Ph.D., '36 and Dr. Marguerite Naps, accidentally discovered a substitute for sponge rubber when a container of soy bean oil and antifreeze liquid boiled over.



*Courtesy The Ohio State University Monthly*

Many of them have other qualities that suit them for specific purposes where natural rubber is not the best performing material. Thus the supply of rubber can be conserved through replacement by other materials. Also rubber substitutes can be employed to ease the rubber problem by mixing them with the pure rubber.

The Northern Regional Research Laboratory has also developed a process of making butadiene from corn and wheat at the rate of approximately seven pounds per bushel. Butadiene is employed in the production of the buna S type of synthetic rubber suitable for the manufacture of tire treads. The process may be applicable to quantity commercial production.

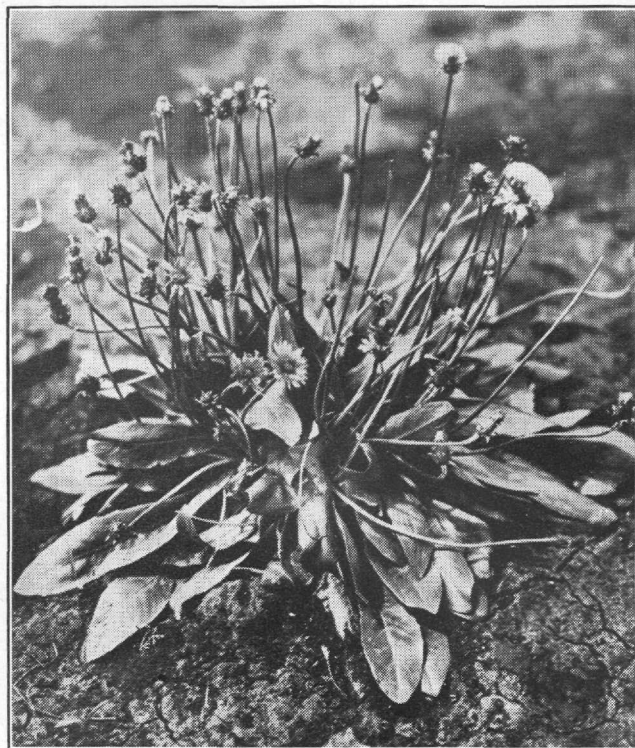
Corn and wheat are fermented to make butylene glycol, a colorless liquid resembling glycerine. After treatment with acetic acid, the liquid is forced under pressure through a hot tube. Then the acid is drawn off, and butadiene is left. The laboratory chemists have attained a yield of 80 per cent butadiene from the butylene glycol.

Perhaps the most practical as a source of rubber from farm plants is the guayule plant. Congress authorized the Department of Agriculture last March to develop the plant as a source of rubber. The greatest obstacle now is the cultivation of guayule.

It has been determined that guayule will grow in almost any section where the temperature does not fall below five above zero. However, the plant produces an appreciable amount of rubber only when there is an approximately equal wet and dry season, and the wet season cannot be very wet. From accumulating evidence it is believed that guayule stores rubber under its bark only through a rainless season. Nevertheless, it requires moisture for growth, and locations suitable for its culture are few.

The guayule is ordinarily not harvested until the end of the fourth year, earlier harvesting resulting in reduced rubber production. The seedlings planted last year will contain about 18 per cent rubber when four years old, yielding about 1200 pounds to the acre. Newer strains being developed yield as much as 24 per cent rubber, dry weight. The rubber is in the plant in the form of actual granules of rubber, and not as the milky latex coming from the rubber tree.

California's guayule project expansion has been retarded by a shortage of seed, but the shortage has been overcome by the successful mechanical harvesting of the seeds from 560 acres of experimental planting in the Salinas Valley. Officials in charge of the project estimate that one pound of seed is sufficient for two acres of plants. Two new nurseries at Indio and Oceanside, together with that in the Salinas Valley, will provide seed-



*Courtesy National Farm Chemurgic Council*

• **Kok-Sagyz, the Russian dandelion.**

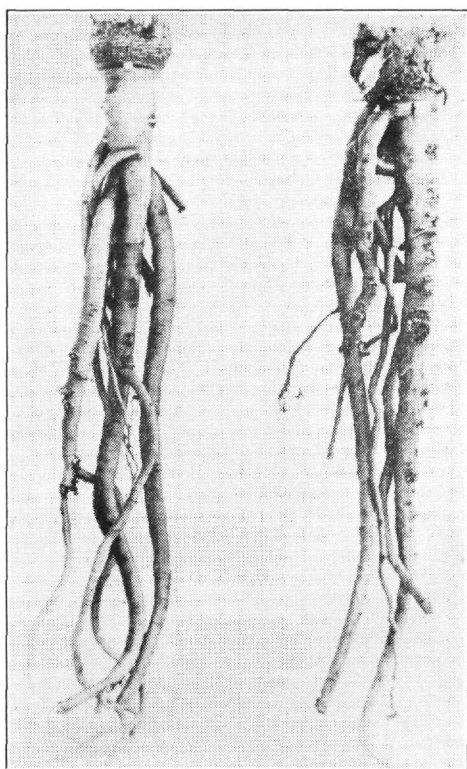
lings for 99,000 acres to be harvested in the fall of 1944. So promising is the development of guayule as a source of rubber that Congress has authorized the planting of 500,000 acres.

Another important plant source of rubber is kok-sagyz, native of Russia. The amount of rubber obtained from the plant as grown in Russia is 6 to 8 per cent dry weight from full-harvested mature roots. So far our test plantings have yielded about 4½ per cent. However, experimentation with the plant may prove valuable, since it is from this plant that Russia secures much of her rubber supply.

One of the best qualities of kok-sagyz is its ability to withstand temperatures as low as 40 degrees below zero. It can be cultivated in almost all regions of the Soviet Union. Because of the large acreage devoted to the plant, Russian scientists have devised special machinery for planting the tiny seeds and for digging the roots.

Last May, 139 pounds of kok-sagyz seed were flown from Russia to Washington, making available to the United States the development of the plant.

The Department of Agriculture reports that kok-sagyz can be grown successfully in the northern range of states, from Vermont to Oregon. It grows best in fertile soils, especially in organic soils such as mucks and peats. Production of roots throughout this range has frequently been 4000 pounds per acre, and at St. Paul nearly 8000 pounds were obtained. The Department empha-



● Roots of  
the Kok-  
Sagyz

Good plants  
yield six  
to eight  
per cent  
rubber  
when dried.

*Courtesy  
National Farm  
Chemurgic  
Council*

sized the experimental nature of this work, and no immediate relief for the rubber shortage is offered.

The alkale deserts of six western states hold 500,000,000 pounds of natural rubber—sufficient to last the United States for five months—available for immediate harvesting, according to University of California scientists. This rubber exists in rabbit brush, large perennial shrubbery covering vast stretches of desert. The brush contains 3 to 7 per cent rubber after drying. Since it is similar to guayule, it is possible that the brush could be gathered and processed in much the same manner as guayule.

Dr. B. L. Hammond and associates at the Bureau of Plant Industry experiment station near Savannah, Georgia, have domesticated strains of goldenrod reaching six feet in height, and containing 6 to 10 per cent of rubber in the leaves. Farmers of the southeast will plant 15,000 acres of the goldenrod this spring in a government experiment.

The production of rubber from plants faces several practical problems, including development of high yielding strains, manufacture of harvesting and processing machinery, and the determination of chemical and mechanical methods of extracting the latex and rubber from various plants.

Despite all the research being performed, the rubber situation will remain very serious. Even if some dependable source of rubber is obtained from factories or farms now, it will be some time before sufficient quantities can be made available so as to remove the restrictions on use of automobiles.